



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/814,381	03/31/2004	Sun-jung Lee	SAM-0527	5506
7590 02/04/2005			EXAMINER	
Anthony P. Onello, Jr. MILLS & ONELLO LLP Suite 605 Eleven Beacon Street Boston, MA 02108			WILKINS III, HARRY D	
			ART UNIT	PAPER NUMBER
			1742	
DATE MAILED: 02/04/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/814,381	Applicant(s) LEE ET AL.	
	Examiner Harry D Wilkins, III	Art Unit 1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 November 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) 1-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 17-31 is/are rejected.
- 7) ☒ Claim(s) 28 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 03/31/04/19.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group II, claims 17-31 in the reply filed on 24 November 2004 is acknowledged.

Claim Objections

2. Claim 28 is objected to because of the following informalities: in line 1, this claim recites "the sensors", however, this should be "the system" as is supported by claim 25. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 17-22, 24 and 29-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Landau (US 6,261,433) in view of Uzoh (US 6,217,734).

Landau teaches the invention substantially as claimed. Landau teaches (see figure 2 and appropriate description) an apparatus for treating a semiconductor device including an electrolyte solution, a wafer chuck 44 for holding the wafer in the treatment chamber, electrodes including main electrode 90 and auxiliary electrodes 84 and a power supply for applying a voltage to the wafer and electrodes. Landau teaches (see col. 11, lines 47-49) placing the auxiliary electrodes inside the electrolyte.

However, Landau does not teach that the apparatus is an electropolishing apparatus where the power source applies a positive voltage to the wafer and a negative voltage to the electrodes. Landau teaches electrodeposition, which is the opposite of electropolishing.

Uzoh teaches (see all of disclosure, particularly col. 1, lines 6-10 and 27-34 and col. 7, lines 34-36) that electrodeposition chambers and electropolishing chambers for processing semiconductor wafers are identical except for the polarity of the applied voltage is reversed such that the anode of one is the cathode of the other.

Therefore, the electrodeposition apparatus of Landau is fully capable of performing as an electropolishing apparatus. In addition, since the auxiliary electrodes would have a continuous cathodic voltage, the concerns of Landau about placing the auxiliary electrodes inside the plating chamber would be allayed since no copper would be deposited on the auxiliary electrodes.

Regarding claims 18-21, Landau teaches (see col. 11, line 13 to col. 12, line 14) that the auxiliary electrodes were used to control the shape of the electrical field inside the electrolyte in order to achieve substantially uniform voltage across the entire wafer

Art Unit: 1742

surface. Particularly, Landau teaches (see col. 11, lines 56-59) activating various auxiliary electrodes in any desired sequence. Therefore, it would have been obvious to one of ordinary skill in the art to have applied voltage first to the main electrode then sequentially to the auxiliary electrodes or to the main and auxiliary electrodes at the same time depending upon the desired results of the processing treatment.

Regarding claim 22, Landau teaches (see col. 11, lines 56-59) that the voltage applied to the auxiliary electrodes may be different from each other in order to adjust the reaction rate to the desired value.

Regarding claim 24, Landau teaches (see col. 11, lines 56-59) using ring shaped concentric auxiliary electrodes.

Regarding claim 29, regarding the limitation that the electrolyte solution contains a phosphoric acid, the above limitation is not further limiting on the apparatus claim because the above limitation deals with the manner or method of use of the claimed apparatus. It has been well settled that the manner or method of use of an apparatus cannot be relied upon to further limit claims to the apparatus itself. See *In re Casey*, 152 USPQ 235, and MPEP 2114.

Regarding claims 30 and 31, Landau teaches (see col. 10, lines 19-21) rotating the substrate holder 44 (i.e.-wafer chuck) when the voltages are applied.

6. Claims 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Landau in view of Uzoh as applied to claim 17 above, and further in view of Downey et al (US 4,358,338).

Landau in view of Uzoh do not teach adding a system for determining the end point of the electropolishing procedure.

Downey et al teach (see abstract and col. 2, lines 37-41) an end point detection system for an etching process which monitors current flowing between a wafer and the electrodes.

Therefore, it would have been obvious to one of ordinary skill in the art to have added the end point detection system of Downey et al to the apparatus of Landau in view of Uzoh because the end point detection system would allow for easy notification for when the etching process had been completed.

7. Claims 25 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Landau in view of Uzoh as applied to claim 17 above, and further in view of Batchelder et al (US 4,977,330).

Landau in view of Uzoh do not teach adding a system for determining the end point of the electropolishing procedure.

Batchelder et al teach (see abstract and col. 3, line 67 to col. 4, line 18) an end point detection system for an etching process which monitors the film thickness of a wafer.

Therefore, it would have been obvious to one of ordinary skill in the art to have added the end point detection system of Batchelder et al to the apparatus of Landau in view of Uzoh because the end point detection system would allow for easy notification for when the etching process had been completed.

Art Unit: 1742

8. Claims 25 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Landau in view of Uzoh as applied to claim 17 above, and further in view of Nakakura et al (US 4,695,479).

Landau in view of Uzoh do not teach adding a system for determining the end point of the electropolishing procedure.

Nakakura et al teach (see abstract and paragraph spanning cols. 2 and 3) an end point detection system for an etching process which monitors the optical properties of the wafer surface.

Therefore, it would have been obvious to one of ordinary skill in the art to have added the end point detection system of Nakakura et al to the apparatus of Landau in view of Uzoh because the end point detection system would allow for easy notification for when the etching process had been completed.

9. Claims 17-24 and 29-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Basol et al (US 2002/0079230 A1 or US 6,802,946 B2) in view of Uzoh (US 6,217,734).

Basol et al teach the invention substantially as claimed. Basol et al teach (see figures 3-8B and appropriate descriptions) an apparatus for treating a semiconductor device including an electrolyte solution 123, a wafer chuck 106 for holding the wafer in the treatment chamber, electrodes including main electrode 112 and mesh auxiliary electrodes 115 or 131 and a power supply for applying a voltage to the wafer and electrodes.

However, Basol et al do not teach that the apparatus is an electropolishing apparatus where the power source applies a positive voltage to the wafer and a negative voltage to the electrodes. Basol et al teach electrodeposition, which is the opposite of electropolishing.

Uzoh teaches (see all of disclosure, particularly col. 1, lines 6-10 and 27-34 and col. 7, lines 34-36) that electrodeposition chambers and electropolishing chambers for processing semiconductor wafers are identical except for the polarity of the applied voltage is reversed such that the anode of one is the cathode of the other.

Therefore, the electrodeposition apparatus of Basol et al is fully capable of performing as an electropolishing apparatus.

Regarding claims 18-21, Basol et al teach (see col. 4, line 15 to col. 5, line 15) that the auxiliary electrodes were used to control the uniformity of the electrochemical reaction at the substrate surface. Therefore, it would have been obvious to one of ordinary skill in the art to have applied voltage first to the main electrode then sequentially to the auxiliary electrodes or to the main and auxiliary electrodes at the same time depending upon the desired properties of the processing treatment in order to achieve the most uniformity.

Regarding claim 22, Basol et al teach (see figure 8A) applying a different voltage to each of the auxiliary electrodes.

Regarding claim 23, Basol et al teach, as above, mesh-type electrodes as the auxiliary electrodes.

Regarding claim 24, Basol et al teach (see figure 8A) using ring shaped concentric auxiliary electrodes.

Regarding claim 29, regarding the limitation that the electrolyte solution contains a phosphoric acid, the above limitation is not further limiting on the apparatus claim because the above limitation deals with the manner or method of use of the claimed apparatus. It has been well settled that the manner or method of use of an apparatus cannot be relied upon to further limit claims to the apparatus itself. See *In re Casey*, 152 USPQ 235, and MPEP 2114.

Regarding claims 30 and 31, Basol et al teaches (see figures 3 and 4) rotating the substrate holder 106 (i.e.-wafer chuck) when the voltages are applied.

10. Claims 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Basol et al in view of Uzoh as applied to claim 17 above, and further in view of Downey et al (US 4,358,338).

Basol et al in view of Uzoh do not teach adding a system for determining the end point of the electropolishing procedure.

Downey et al teach (see abstract and col. 2, lines 37-41) an end point detection system for an etching process which monitors current flowing between a wafer and the electrodes.

Therefore, it would have been obvious to one of ordinary skill in the art to have added the end point detection system of Downey et al to the apparatus of Basol et al in view of Uzoh because the end point detection system would allow for easy notification for when the etching process had been completed.

Art Unit: 1742

11. Claims 25 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Basol et al in view of Uzoh as applied to claim 17 above, and further in view of Batchelder et al (US 4,977,330).

Basol et al in view of Uzoh do not teach adding a system for determining the end point of the electropolishing procedure.

Batchelder et al teach (see abstract and col. 3, line 67 to col. 4, line 18) an end point detection system for an etching process which monitors the film thickness of a wafer.

Therefore, it would have been obvious to one of ordinary skill in the art to have added the end point detection system of Batchelder et al to the apparatus of Basol et al in view of Uzoh because the end point detection system would allow for easy notification for when the etching process had been completed.

12. Claims 25 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Basol et al in view of Uzoh as applied to claim 17 above, and further in view of Nakakura et al (US 4,695,479).

Basol et al in view of Uzoh do not teach adding a system for determining the end point of the electropolishing procedure.

Nakakura et al teach (see abstract and paragraph spanning cols. 2 and 3) an end point detection system for an etching process which monitors the optical properties of the wafer surface.

Therefore, it would have been obvious to one of ordinary skill in the art to have added the end point detection system of Nakakura et al to the apparatus of Basol et al

in view of Uzoh because the end point detection system would allow for easy notification for when the etching process had been completed.

Conclusion

13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.


- a. Chou et al (US 2003/0205477 A1) teach an auxiliary electrode 32 which causes flow reversal in a electrodeposition process.
- b. Tran et al (US 6,425,991 B1) teach an auxiliary sacrificial anode in an electrodeposition process.
- c. Chen et al (US 6,565,729 B2) teach a plurality of concentric annular electrodes for causing a uniform electric field across a silicon wafer, however, there is no main electrode.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Harry D Wilkins, III whose telephone number is 571-272-1251. The examiner can normally be reached on M-Th 10am-8:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy V King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1742

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Harry D Wilkins, III
Examiner
Art Unit 1742

hdw